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(54) **Portable telephone and additional device for the same**

Tragbarer Telefonapparat und Zusatzvorrichtung dafür

Téléphone portable et appareil accessoire pour celui-ci

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Description

[0001] The present invention relates to a portable telephone and an additional device detachably connected to the portable telephone.

[0002] The United States Patent US 5,136,229 discloses a power pack unit designed for use with a portable cellular telephone having a rechargeable battery pack. The power pack is sandwiched between the cellular telephone and the rechargeable battery. The power pack is designed to be optionally operated from an external power supply, such as the cigarette lighter socket of an automobile.

[0003] A conventional portable telephone P as shown in Fig. 1 has a portable telephone main body 10 and a battery 20 detachably attached to the portable telephone main body 10. The portable telephone main body 10 has, on its bottom, a connector 11 for connecting to external equipment, as shown in Figs. 1 to 4.

[0004] In the portable telephone P having the above-mentioned constitution, the portable telephone main body 10 operates on power fed from the battery 20.

[0005] However, when a power source is additionally provided in order to prolong the conversation time of the portable telephone main body 10, it is necessary to connect an external power source to the connector 11 for external equipment connection disposed in the portable telephone main body 10.

[0006] As shown in Fig. 5, in order to connect external equipment 40 to the portable telephone P having the above-mentioned constitution, a repeater 60 is required between the portable telephone main body 10 and the external equipment 40. For example, when the portable telephone main body 10 is connected to the external equipment 40 as a terminal for computer communication, an analog or digital signal is fed from the portable telephone main body 10. In case of an analog signal, the repeater 60 is a modem in order to provide a signal format converted into a digital signal and then fed to the external equipment 40.

[0007] When the conventional portable telephone with a power source is connected to the external equipment or modified to increase functions, the power source or an additional device such as the repeater for increasing the functionality must be connected to the connector 11 of the portable telephone main body 10. As a consequence, the additional device is not integral with the portable telephone main body 10, so that the portability of the portable telephone P deteriorates.

[0008] The Japanese Patent Application No. 99093/1992 discloses radio equipment which is detachably equipped with a battery pack. In this radio equipment, a lug is formed in the vicinity of the lower end of the radio main body. A locking piece and a knob are disposed on the upper side thereof, and a recess for engaging with the lug of the radio equipment main body is formed in the battery pack to facilitate the detachment of the battery.

[0009] An object of the present invention is to provide a portable telephone of improved portability when a power source is additionally provided, whereby the functionality of the portable telephone is to be increased.

[0010] According to the invention an auxiliary device for a portable telephone is provided as defined in claim 1. A portable telephone system is also provided as defined in claim 3.

[0011] In the portable telephone system of the present invention, the additional device can be detachably attached to the portable telephone main body having a connection function with a telephone line or network. With the auxiliary device of the present invention, various functions are provided for the portable telephone, whereby a device connected as an external device can be integrally mounted on the portable telephone main body to improve the portability.

[0012] When the above-mentioned auxiliary equipment for the portable telephone has a modem function, computer communication can be established by connecting to a communication terminal by the use of a connector set. Furthermore, the auxiliary device for the portable telephone can have an extension function for extending the memory capacity of the portable telephone. In a further arrangement a chip type IC card can be received in the auxiliary device, where the function of the portable telephone can be extended in accordance with the information stored in this chip type IC card.

Fig. 1 is a front view illustrating a conventional portable telephone.

Fig. 2 is an enlarged perspective view of the bottom of the portable telephone shown in Fig. 1.

Fig. 3 is a right side view of the portable telephone shown in Fig. 1.

Fig. 4 is a left side view of the portable telephone shown in Fig. 1.

Fig. 5 is an explanatory view illustrating a use state of the conventional portable telephone.

Fig. 6 is a front view of a portable telephone in an embodiment of the present invention.

Fig. 7 is an enlarged perspective view of the bottom of the portable telephone shown in Fig. 6.

Fig. 8 is a right side view of the portable telephone shown in Fig. 6.

Fig. 9 is a left side view of the portable telephone shown in Fig. 6.

- Fig. 10 is an exploded perspective view of the portable telephone.
- Fig. 11 is an exploded perspective view of the portable telephone.
- Fig. 12 is a constitutional view illustrating the constitution of the portable telephone main body.
- Fig. 13 is a constitutional view illustrating the constitution of an additional device for the portable telephone in the first embodiment.
- Fig. 14 is a front view illustrating a use state of the portable telephone utilizing an additional device for the portable telephone in the second embodiment.
- Fig. 15a is a front view of a connector set.
- Fig. 15b is a plan view of the connector set.
- Fig. 15c is a right side view of the connector set.
- Fig. 16 is a partially broken sectional view illustrating a connection state between the connector set and other members.
- Fig. 17 is a constitutional view illustrating the constitution of the portable telephone in the second embodiment.
- Fig. 18a is an explanatory view illustrating a power source feed direction in the case of the first embodiment.
- Fig. 18b is an explanatory view illustrating a power source feed direction in the case that a power source is fed from a battery in the second embodiment.
- Fig. 18c is an explanatory view illustrating a power source feed direction in the case that a power source is fed from an external power source in the second embodiment.
- Fig. 19 is a constitutional view illustrating the constitution in which the external power source is connected in the second embodiment.
- Fig. 20 is a constitutional view illustrating the constitution of the fourth embodiment.
- Fig. 21a is a plan view of an additional device for the portable telephone in the fifth embodiment.
- Fig. 21b is its front view.
- Fig. 21c is its base view.
- Fig. 21d is its rear view.
- Fig. 21e is its right side view.
- Fig. 22 is a perspective view illustrating the additional device for the portable telephone and a chip type IC card in the fifth embodiment.
- Fig. 23 is a plan view of the additional device for the portable telephone in the fifth embodiment.
- Fig. 24 is a partially enlarged view of the additional device in Fig. 22.
- Fig. 25 is a constitutional view illustrating the constitution of the portable telephone in the fifth embodiment.
- [0013]** Embodiments of the present invention will be described with reference to drawings. In the drawings, the same members as the conventional members and corresponding portions are represented by the same numerals, and their description will be omitted.
- [0014]** As shown in Fig. 6, a portable telephone in this embodiment comprises a portable telephone main body 10, an additional or auxiliary device 30 connected to and detachably attached to the portable telephone main body 10, and a battery 20 connected to and detachably attached to the additional device 30. Furthermore, as shown in Figs. 6, 7, 10 and 11, the portable telephone main body 10 has a connector 11 for external connection. The additional device 30 for the portable telephone also has a connector 31 for external connection. Each of the connectors 11 and 31 is constituted of multipolar pins and provides connection for a power source and for input/output of signals. Here, the connector 31 provides different functions to the device 30 for the portable telephone. As mentioned above, various types of devices having different functions can be prepared, and the user can select the desirable type, as needed.
- [0015]** As described above, the additional or auxiliary device 30 for the portable telephone is detachable from the portable telephone main body 10. The power source or battery 20 is also detachable from the additional device 30. In addition, the battery 20 is also detachable from the portable telephone main body 10. That is, as shown in Fig. 10, the hatched surface of the additional device 30 which faces the portable telephone main body 10 is formed so as to have the same shape and the same size as the hatched surface of the battery 20 facing the additional device 30. Furthermore, as shown in Fig. 11, the hatched surface of the portable telephone main body 10 which faces the additional device 30 is formed so as to have the same shape and the same size as the hatched surface of the additional device 30 facing the

battery 20. Thus, the functionality of the portable telephone can be extended by simply providing the additional intermediate device 30 in the portable telephone arrangement. The conventional portable telephone comprising the portable telephone main body 10 and the battery 20 can still be utilized as it is or extended with the additional or auxiliary device.

[0016] The portable telephone main body 10 has the function of the portable telephone. As shown in Fig. 12, this portable telephone main body 10 has a connector 11, a battery terminal 12, an internal circuit 13 and an antenna 17. This internal circuit 13 has a transmitting/receiving section 14, a CPU 15 and a memory/peripheral circuit 16.

[0017] Various types of auxiliary devices 30 for the portable telephone can be prepared, and they can be optionally exchanged by the user of the portable telephone. Next, some embodiments of the additional devices for the portable telephone will be described.

First Embodiment

[0018] In the first embodiment, an additional device 30a for the portable telephone having a battery function will be described. The additional device 30a, as shown in Fig. 13, has a power source section 34a, a battery terminal 32 for connection to the portable telephone main body 10, and a battery terminal 33 for connection to the battery 20. Not only the power source section 34a of this additional device 30a but also the battery 20 are electrically chargeable. The battery terminal 32 for connecting to the portable telephone main body 10 is formed so as to have the same shape as a battery terminal 22 disposed on the normal power source or battery 20. The battery terminal 33 for connecting to the battery 20 is formed so as to have the same shape as the battery terminal 12 provided in the portable telephone main body 10. In addition, the mutually facing terminals are symmetrically formed. An electric current is provided to an internal circuit showed in Fig. 13 through the battery terminals 12, 32, 33, 22. Also the portable telephone main body 10 and the additional device 30a can be detachably attached to each other by the battery terminal 12 and the battery terminal 32. The additional device 30a and the battery 20 can be detachably attached to each other by the battery terminal 33 and the battery terminal 22. It is possible to connect the respective parts to each other by connecting members other than the battery terminals 12, 32, 33, 22. Moreover, the shape and the constitution of the additional device 30a are the same as shown in Figs. 6 to 11.

[0019] The installation of the additional device 30a for the portable telephone permits prolonging the stand-by time and the conversation time which have been short when using the battery 20 alone. This principle is the same as the parallel connection of dry cells, whereby the telephone use time can be prolonged.

Second Embodiment

[0020] Next, the second embodiment will be described. In the above-mentioned first embodiment, the additional device 30a having the battery function has been described. In the second embodiment, the additional device 30b for the portable telephone according to the invention is equipped with a modem function which is required for computer communication or the like.

[0021] A portable telephone B, as shown in Fig. 14, comprises the portable telephone main body 10, the additional device 30b for the portable telephone, the power source or battery 20 and a connector set 50. The shape of the portable telephone main body 10, the additional device 30b and the battery 20 is the same as shown in Figs. 6 to 11. The connector set 50 has a connector 51 for connection to the portable telephone main body 10, a connector 53 for connection to the additional device 30b for the portable telephone, and a connector 55 for connection to external equipment 40, as shown in Fig. 14. The connectors 51, 53 are arranged on a substrate 57 disposed in the connector set 50 as shown in Fig. 16. Each of these connectors 51, 53, 55 comprises multipolar pins. The connector 51 is detachably engaged with the connector 11 of the portable telephone main body 10. The connector 53 is detachably engaged with the connector 31 of the additional device 30b for the portable telephone. As described above, the portable telephone main body 10 and the additional device 30b for the portable telephone are connected to the connector set 50, and therefore fixation therebetween can be strengthened. In this case, the external equipment 40 is, for example, a communication terminal for computer communication.

[0022] Next, the usage of the portable telephone B regarding the second embodiment will be described. As shown in Fig. 17, the portable telephone main body 10 is electrically connected to the additional or auxiliary device 30b for the portable telephone having a modem function via the connector set 50. A signal from the external equipment 40 as the communication terminal connected to the connector set 50 is transmitted to an internal circuit 32b via the connector 55, the connector 53 and the connector 31 of the additional device 30b for the portable telephone. In this internal circuit 32b, the signal from the external equipment 40 is processed. That is, the digital signal from the external equipment 40 is converted into an analog signal. This analog signal is transmitted to the portable telephone main body 10 via the connector 31, the connector 53 of the connector set 50, the connector 51 and the connector 11 of the portable telephone main body 10. The portable telephone main body 10 connects the input signal to a telephone network, thereby carrying out computer communication. The CPU 15 in the internal circuit 13 processes the signal so as to be suitable for the portable telephone, for example, converts the signal into a digital signal. The

transmitting/receiving section 14 then transmits the signal via the antenna 17. Incidentally, the reception of the signal can be carried out by reversing the procedure of the signal transmission.

[0023] In the above-mentioned second embodiment, power is fed from the battery 20 connected to the additional device 30b, but the external equipment 40 as well as an external power source 45 may be connected to the connector 55 of the connector set 50.

[0024] Now, the connection of the battery 20 to other equipment will be described. In the portable telephone A of the first embodiment, the portable telephone main body 10 is connected to the additional device 30a and the battery 20 as shown in Fig. 12. Thus the power of the battery 20 can be fed to the portable telephone main body 10 via the additional device 30a, as shown by an arrow in Fig. 18 (a).

[0025] The power supply from the battery 20 to the additional device 30b is carried out via the battery terminals 22, 33, as shown in Fig. 18 (b). The power supply to the portable telephone main body 10 is carried out via the connector set 50. That is, the power is fed from the additional device 30b to the portable telephone main body 10 via the connectors 53, 51.

[0026] In the case that the power is fed from the external power source 45, power is supplied to the portable telephone main body 10 and the additional device 30b via the connector 55 of the connector set 50 and the connectors 51, 53, respectively, as shown in Fig. 18 (c). The system equipped with the external power source 45 will be described in more detail. As shown in Fig. 19, the connector set 50 is connected to the additional device 30b. A switch 38b disconnects the power feed line extending to the battery 20 by the operation of the internal circuit and connects a line extending to the external power source 45, so that the power supply to the additional device 30b can be achieved by power supply to the internal circuit 32b via the connectors 55, 53 and the switch 38b. Power supply to the portable telephone main body 10 is achieved by feeding the power to the internal circuit 13 via the connectors 53, 51. When the external power source 45 is connected, the external equipment 40 is also connected to the connector set 50 via the connector 55, and the signal from the external equipment 40 is processed in the internal circuit 32b, as in the case of Fig. 17. Afterward, the processed signal is transmitted to the internal circuit 13 of the portable telephone main body 10.

[0027] As described above, when the additional or auxiliary device 30b for the portable telephone has the modem function, data can be transferred between distantly separated computers. When the external power source 45 is provided, the data transfer is possible for a long period of time.

Third Embodiment

[0028] A portable telephone C of the third embodi-

ment has a similar constitution as in the second embodiment except that the communication terminal, which is the external equipment 40 in the second embodiment, is replaced with a device having a facsimile function. In this case, the additional device 30b has a function for sending/receiving data between the external equipment 40 as the facsimile machine and the portable telephone main body 10. The usual facsimile has a modem therein, and therefore FAX communication is carried out by directly connecting the facsimile machine to the connector 11 of the portable telephone main body 10.

[0029] Next, the fourth embodiment will be described. In the above-mentioned first to third embodiments, the additional devices 30a or 30b for the portable telephone had the battery function, the analog/digital terminal, or the multimedia function. However, this fourth embodiment has an extension function.

Fourth Embodiment

[0030] In a portable telephone D of the fourth embodiment, the constitution of the portable telephone main body 10 and the battery 20 is the same as shown in Figs. 6 to 11. The constitution of the connector set 50 is the same as in the second embodiment. However, the auxiliary device 30d for the portable telephone according to the invention has a CPU 33d and a memory/peripheral circuit 34c, as shown in Fig. 20. The CPU 15 in the internal circuit 13 in the portable telephone main body 10 is connected to the CPU 33d by serial communication, and sending/receiving of data can be carried out between both the CPUs. As described above, the additional installation of the CPU 33d and the memory/peripheral circuit 34d permits extending the function of the portable telephone main body 10. According to the invention a memory capacity can be increased. The function of conversation recording and absence-during-recording can be extended, and such various functions as in a portable telephone can be provided.

Fifth Embodiment

[0031] Next, the fifth embodiment of the present invention will be described. A portable telephone E according to this fifth embodiment also has a mechanism for extending the functionality of the portable telephone.

[0032] That is, the auxiliary device 30e for the portable telephone functions as a chip type IC card receiving device. As shown in Figs. 21 to 24, the additional device 30e for the portable telephone has a card gate 35e into which a chip type IC card 37e is inserted. The chip type IC card 37e can be completely arranged in the additional device 30e through this card gate 35e. Furthermore, the additional device 30e has a card ejection switch 36e. When this card ejection switch 36e is pushed, the chip type IC card 37e can be ejected by a soft-based or a hard-based drive.

[0033] Moreover, the additional device 30e for the

portable telephone has the connector 31, battery terminal 33, a CPU 33e, a peripheral circuit 34e and a card interface circuit 38e therein, as in the above-mentioned embodiment. In this respect, the constitution of the portable telephone main body 10 and the battery 20 is the same as in the case of the embodiments shown in Figs. 6 to 11.

[0034] The operation of the auxiliary device 30e for the portable telephone in this embodiment will be described. The reading of the information in the chip type IC card 37e and the predetermined processing of a signal are carried out by the card interface circuit 38e, the peripheral circuit 34e and the CPU 33e. An information signal is sent to the internal circuit 13 in the portable telephone main body 10, as shown in Fig. 25. In this way, the function of the portable telephone main body 10 can be extended in accordance with the information on the chip type IC card 37e. For example, a function such as the increase of memory capacity for telephone numbers by abbreviated dialling can be extended. That is, the function of the portable telephone main body 10 can be extended or changed by simply preparing specific IC cards 37e and selecting a desirable one from the prepared cards.

Claims

1. An auxiliary device suitable for use with a portable telephone which includes a portable telephone main body and a power source, said auxiliary device comprising:

connecting members for releasable attachment of the auxiliary device to both said portable telephone main body and said power source; and

a power terminal (33) releasably attachable to a terminal of said power source,

characterized in that said auxiliary device further comprises means (32b, 33d, 33e) for enhancing the functional capabilities to transmit data to and from the portable telephone including one of the following units:

a) an internal circuit (32b) providing a modem function of modulating/demodulating an input signal, the internal circuit (32b) being connectable to external equipment;

b) a CPU (33d) and a memory (34c), said CPU (33d) being connectable to said portable telephone main body for sending and receiving data;

or

c) receiving means (35e) for a chip type IC card,

a card interface circuit (38e) for reading the IC card and a CPU (33e) for processing information stored on the IC card, said CPU (33e) being connectable to the portable telephone main body.

2. The auxiliary device according to Claim 1 when provided with the unit (a), wherein said internal circuit (32b) is simultaneously connectable to said external equipment and to an external power source.
3. A portable telephone system, comprising:
 - a portable telephone main body (10) for communication with a telephone network;
 - a power source (20) having a terminal (22) for supplying power to the portable telephone main body (10); and
 - an auxiliary device as defined in Claim 1 or 2.
4. The portable telephone system according to Claim 3, further comprising a connector set (50) having a first connector (51) removably attachable to an input/output terminal (11) provided on the portable telephone main body (10), a second connector (53) removably attachable to an input/output terminal (31) provided on said auxiliary device and a third connector (55) capable of being connected to external equipment and/or an external power source.

Patentansprüche

1. Zusatzvorrichtung, die zum Gebrauch mit einem tragbaren Telefon geeignet ist, das ein tragbares Telefonhauptgehäuse und eine Energieversorgung aufweist, wobei die Zusatzvorrichtung folgendes aufweist:

- Verbindungselemente zum lösbaren Anbringen der Zusatzvorrichtung sowohl an dem tragbaren Telefonhauptgehäuse als auch an der Energieversorgung; und
- einen Energieversorgungsanschluß (33), der an einem Anschluß der Energieversorgung lösbar anbringbar ist,

dadurch gekennzeichnet,

daß die Zusatzvorrichtung ferner Einrichtungen (32b, 33d, 33e) zum Verbessern der funktionellen Fähigkeiten aufweist, um Daten zu und von dem tragbaren Telefon zu übertragen, wobei die Einrichtungen eine der folgenden Einheiten aufweisen:

- a) eine interne Schaltung (32b), die eine Modemfunktion zum Modulieren/Demodulieren ei-

nes Eingangssignals bietet, wobei die interne Schaltung (32b) mit einer externen Einrichtung verbindbar ist;

b) eine CPU (33d) und einen Speicher (34c), wobei die CPU (33d) mit dem tragbaren Telefonhauptgehäuse zum Senden und Empfangen von Daten verbindbar ist; oder

c) eine Empfangseinrichtung (35e) für eine IC-Karte vom Chiptyp, eine Kartenschnittstellenschaltung (38e) zum Lesen der IC-Karte und eine CPU (33e) zum Verarbeiten von auf der IC-Karte gespeicherter Information, wobei die CPU (33e) mit dem tragbaren Telefonhauptgehäuse verbindbar ist.

2. Zusatzvorrichtung nach Anspruch 1, die sie mit der Einheit (a) versehen ist, wobei die interne Schaltung (32b) gleichzeitig mit der externen Einrichtung und mit einer externen Energieversorgung verbindbar ist.

3. Tragbares Telefonsystem, das folgendes aufweist:

ein tragbares Telefonhauptgehäuse (10) zur Kommunikation mit einem Telefonnetz; eine Energieversorgung (20), die einen Anschluß (22) hat, um dem tragbaren Telefonhauptgehäuse (10) Energie zuzuführen; und eine Zusatzvorrichtung nach Anspruch 1 oder 2.

4. Tragbares Telefonsystem nach Anspruch 3, das ferner einen Verbindersatz (50) besitzt, der folgendes aufweist: einen ersten Verbinder (51), der an einem an dem tragbaren Telefonhauptgehäuse (10) vorgesehenen Eingangs/Ausgangsanschluß (11) lösbar anbringbar ist, einen zweiten Verbinder (53), der an einem an der Zusatzvorrichtung vorgesehenen Eingangs/Ausgangsanschluß (31) lösbar anbringbar ist, und einen dritten Verbinder (55), der mit der externen Einrichtung und/oder einer externen Energieversorgung verbindbar ist.

Revendications

1. Appareil auxiliaire adapté pour être utilisé avec un téléphone portable qui comprend un corps principal de téléphone portable et une source de puissance, ledit appareil auxiliaire comprenant :

des éléments de raccordement pour fixer de manière amovible l'appareil auxiliaire à la fois sur ledit corps principal de téléphone portable et ladite source de puissance ; et une borne de puissance (33) pouvant être fixée de manière amovible à une borne de ladite source de puissance,

caractérisé en ce que ledit appareil auxiliaire comprend en outre des moyens (32b, 33d, 33e) pour améliorer les capacités fonctionnelles pour transmettre des données vers et depuis le téléphone portable comprenant l'une des unités suivantes :

a) un circuit interne (32b) offrant une fonction modem de modulation/démodulation d'un signal d'entrée, le circuit interne (32b) pouvant être raccordé à un équipement externe ;

b) une unité centrale (33d) et une mémoire (34c), ladite unité centrale (33d) pouvant être raccordée audit corps principal de téléphone portable pour envoyer et recevoir des données ;

ou

c) des moyens de réception (35e) pour une carte à circuit intégré de type puce, un circuit d'interface de carte (38e) pour lire la carte à circuit intégré et une unité centrale (33e) pour traiter des informations stockées sur la carte à circuit intégré, ladite unité centrale (33e) pouvant être raccordée au corps principal de téléphone portable.

2. Appareil auxiliaire selon la revendication 1, lorsqu'il est muni de l'unité (a), dans lequel ledit circuit interne (32b) peut être raccordé simultanément audit équipement externe et à une source de puissance externe.

3. Système de téléphone portable, comprenant :

un corps principal de téléphone portable (10) permettant de communiquer avec un réseau téléphonique ;

une source de puissance (20) ayant une borne (22) pour fournir de la puissance au corps principal de téléphone portable (10) ; et

un appareil auxiliaire selon la revendication 1 ou 2.

4. Système de téléphone portable selon la revendication 3, comprenant en outre un ensemble de connecteur (50) ayant un premier connecteur (51) pouvant être fixé de manière amovible à une borne d'entrée/sortie (11) ménagée sur le corps principal de téléphone portable (10), un deuxième connecteur (53) pouvant être fixé de manière amovible à une borne d'entrée/sortie (31) prévue sur ledit appareil auxiliaire et un troisième connecteur (55) capable d'être raccordé à un équipement externe et/ou à une source de puissance externe.

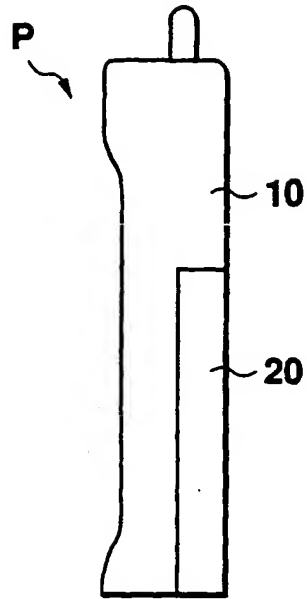


Fig. 1

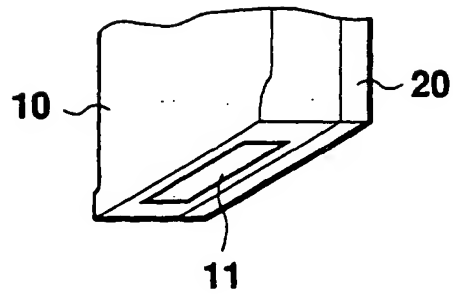


Fig. 2

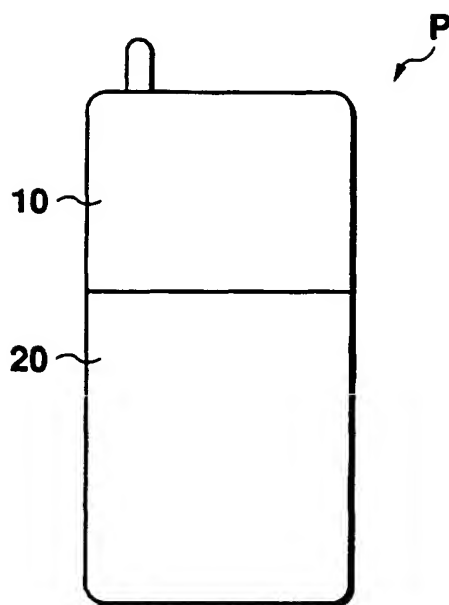


Fig. 3

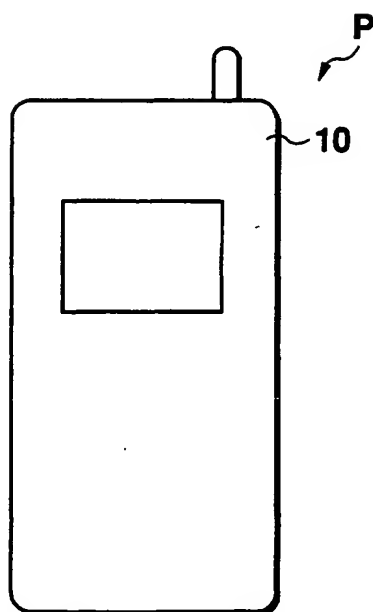


Fig. 4

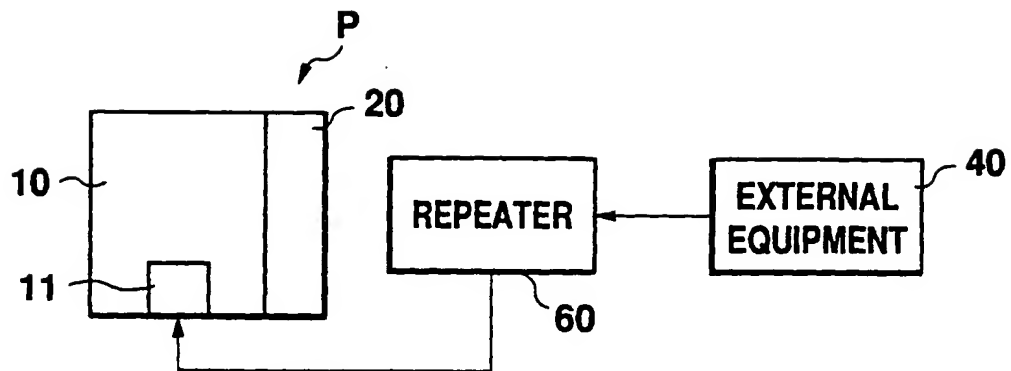


Fig. 5

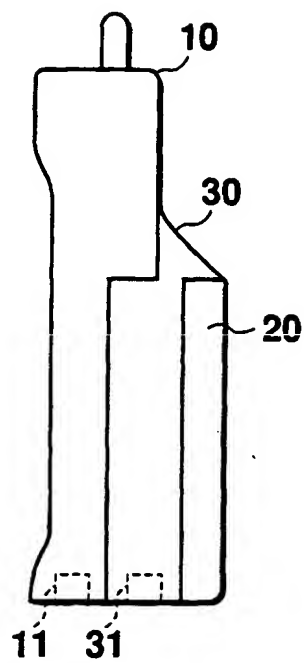


Fig. 6

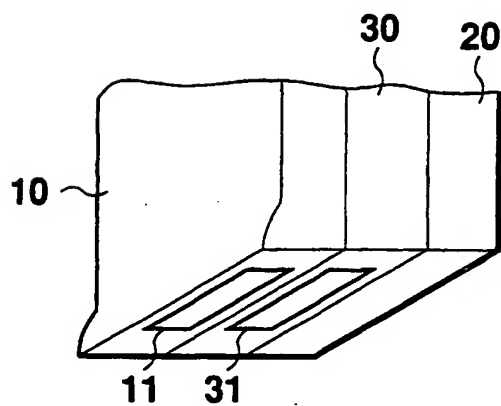


Fig. 7

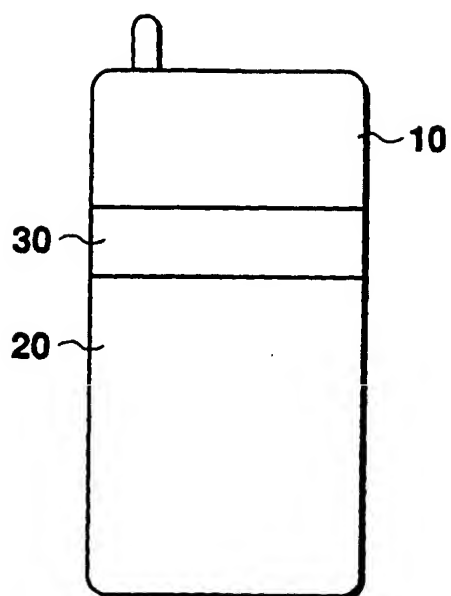


Fig. 8

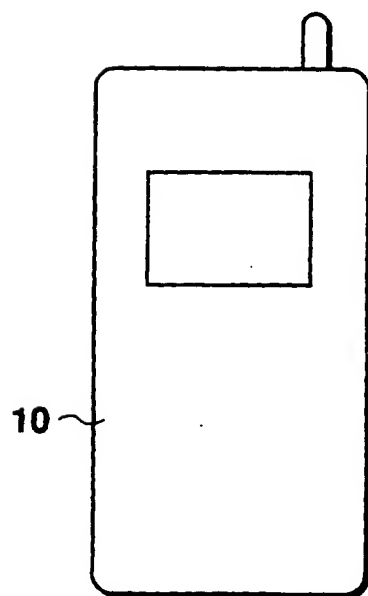


Fig. 9

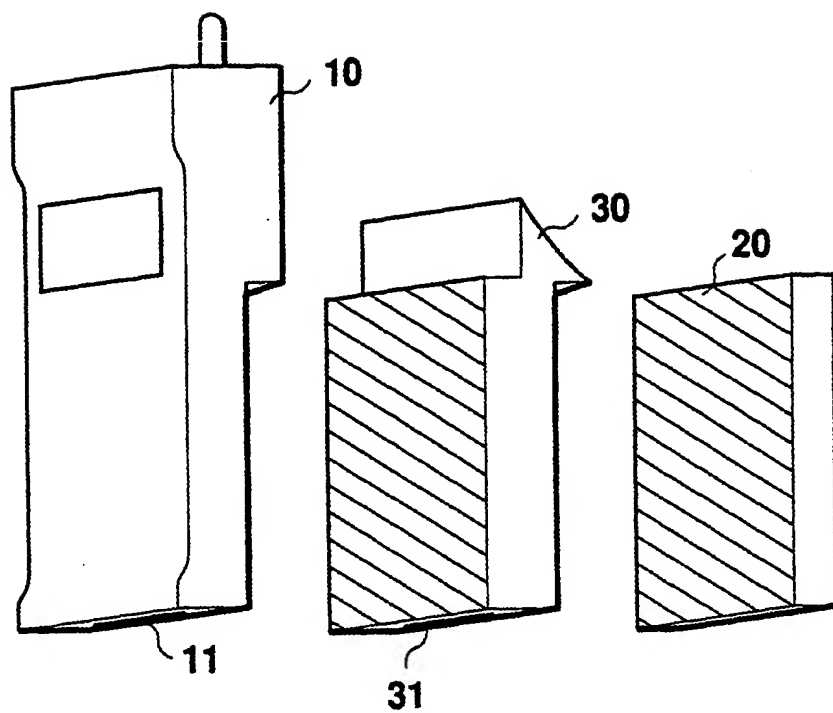


Fig. 10

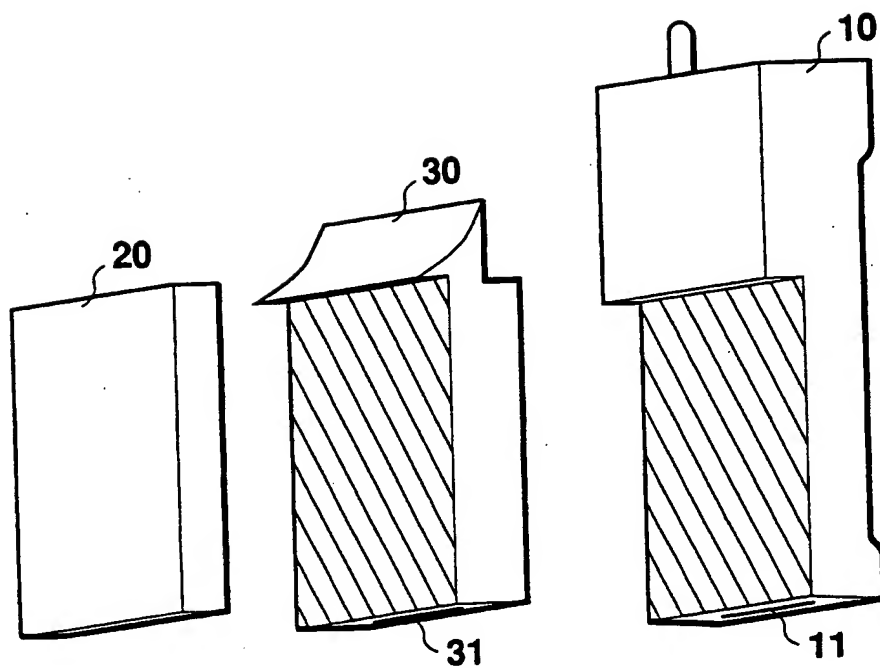


Fig. 11

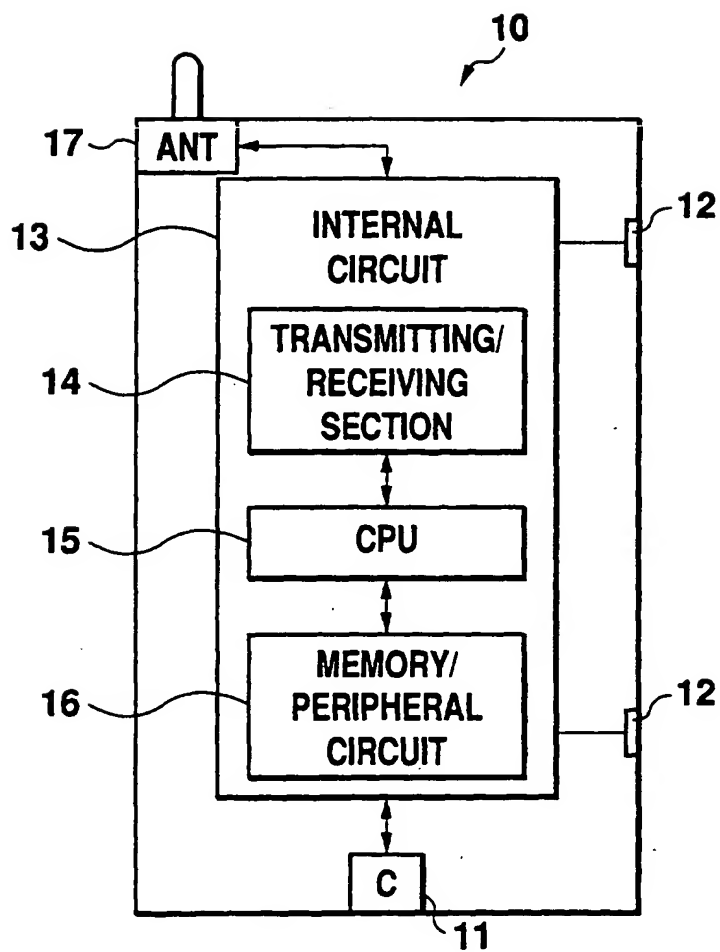


Fig. 12

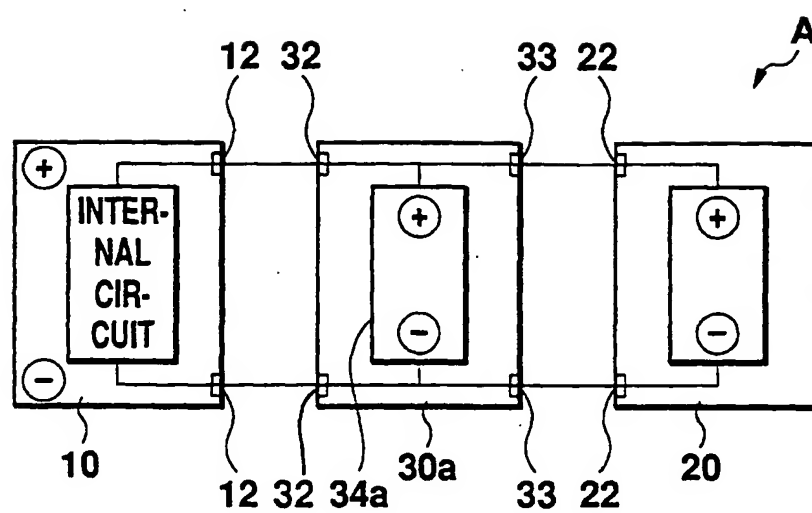


Fig. 13

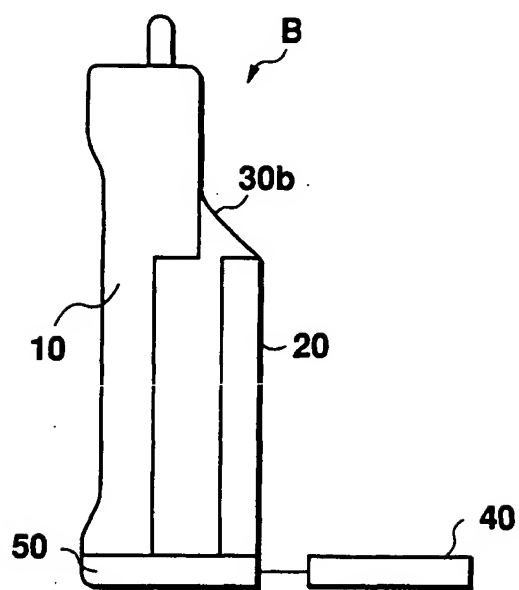


Fig. 14

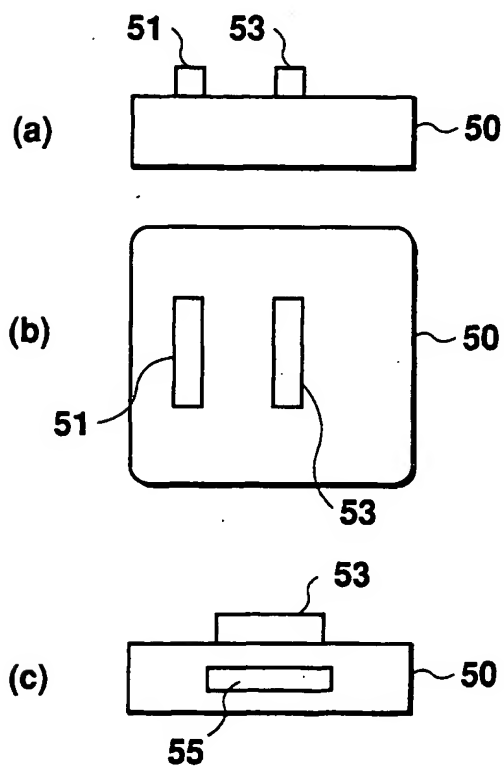


Fig. 15

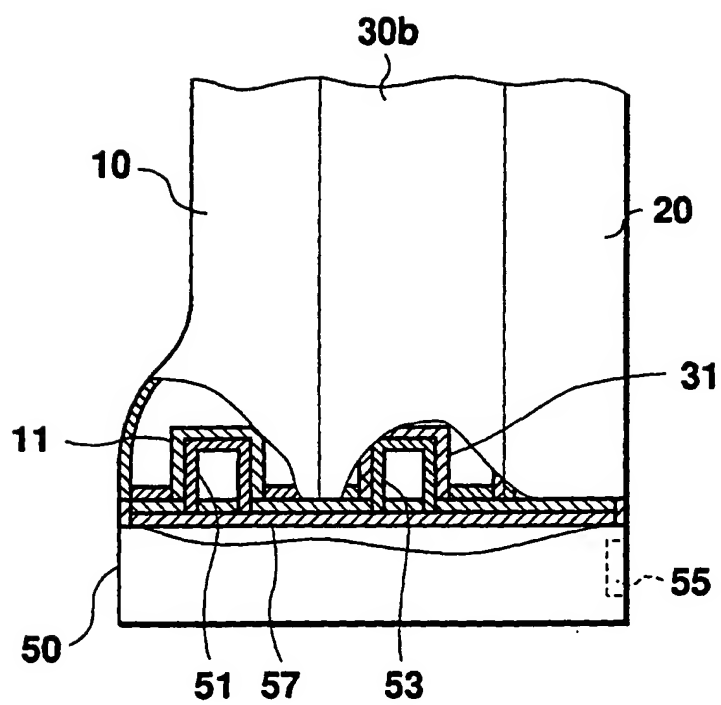


Fig. 16

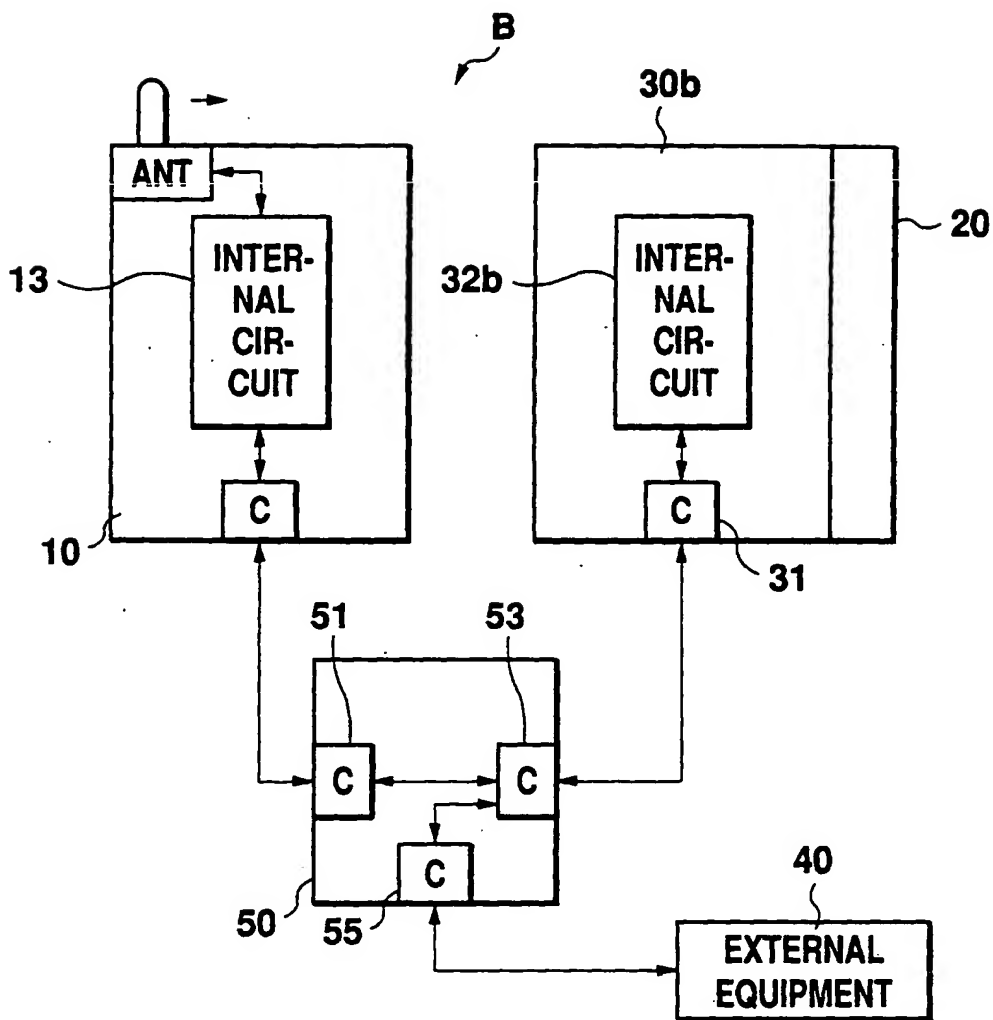
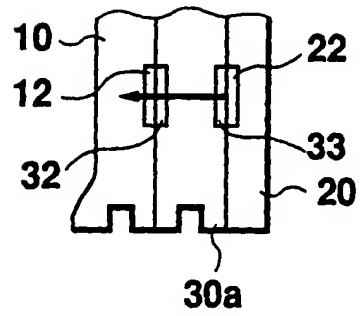
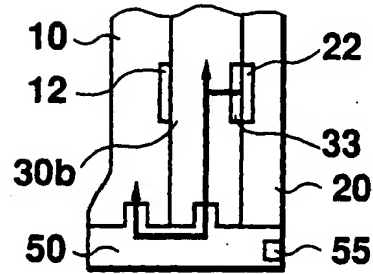


Fig. 17

(a)



(b)



(c)

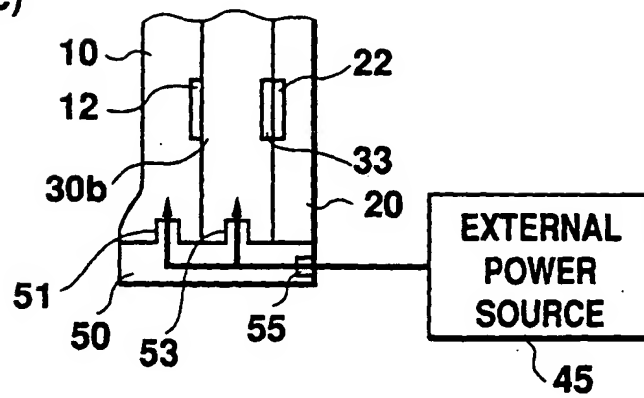
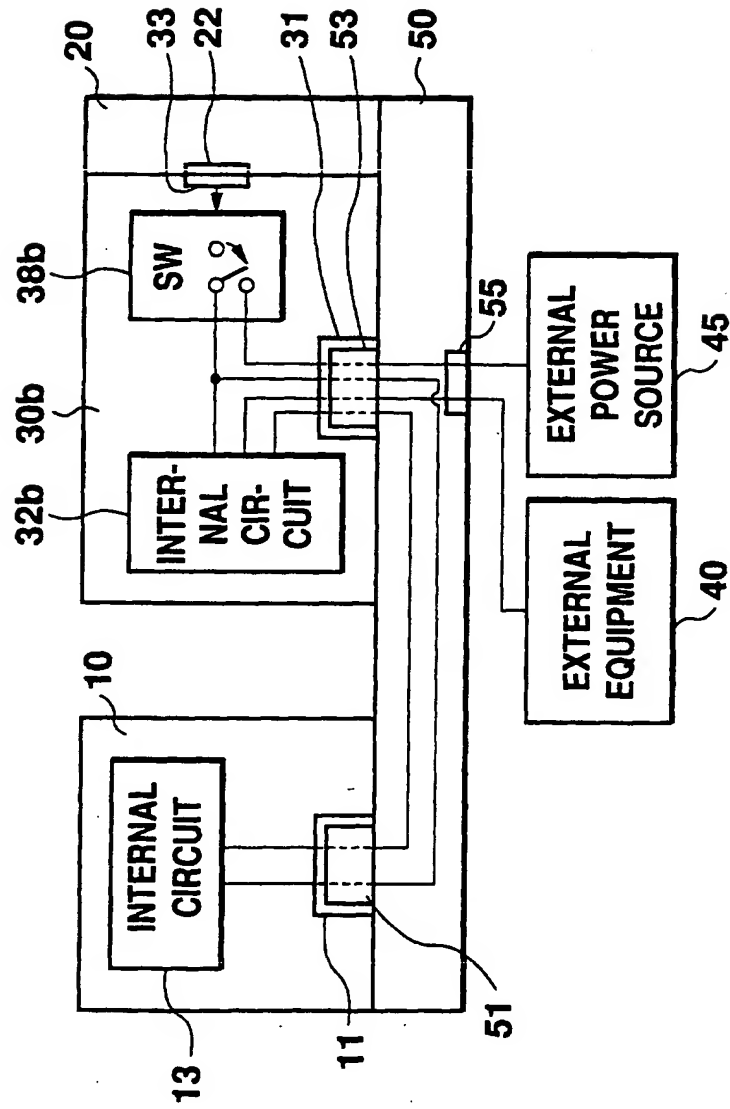


Fig. 18



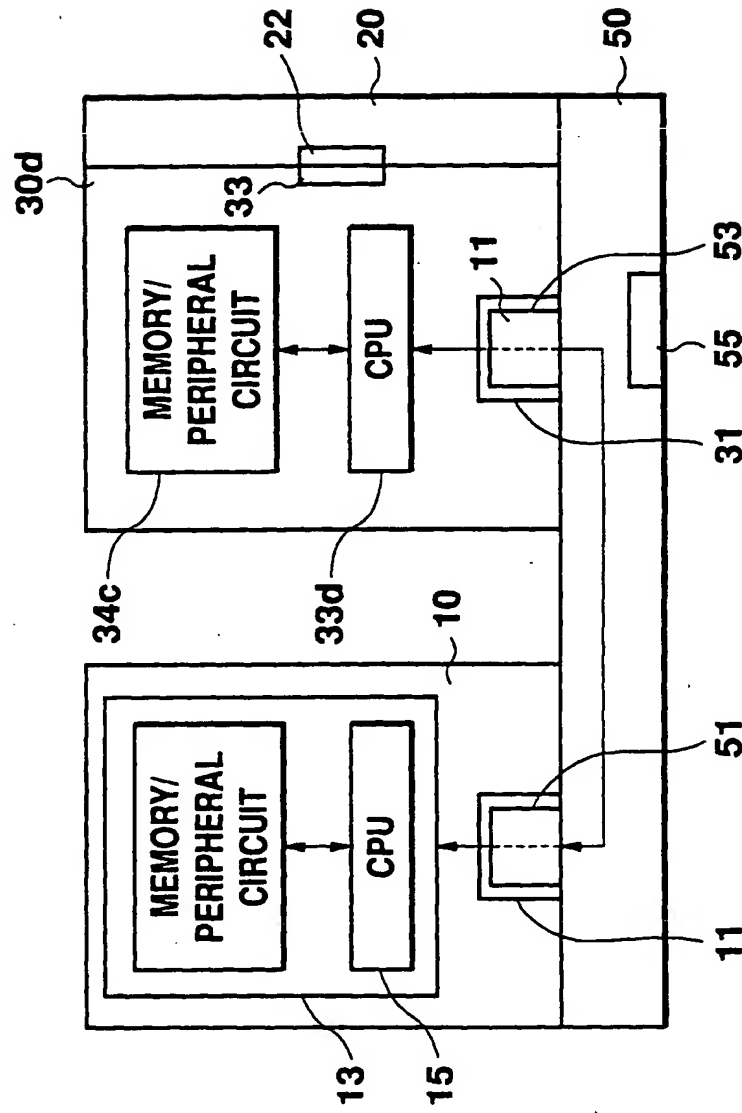


Fig. 20

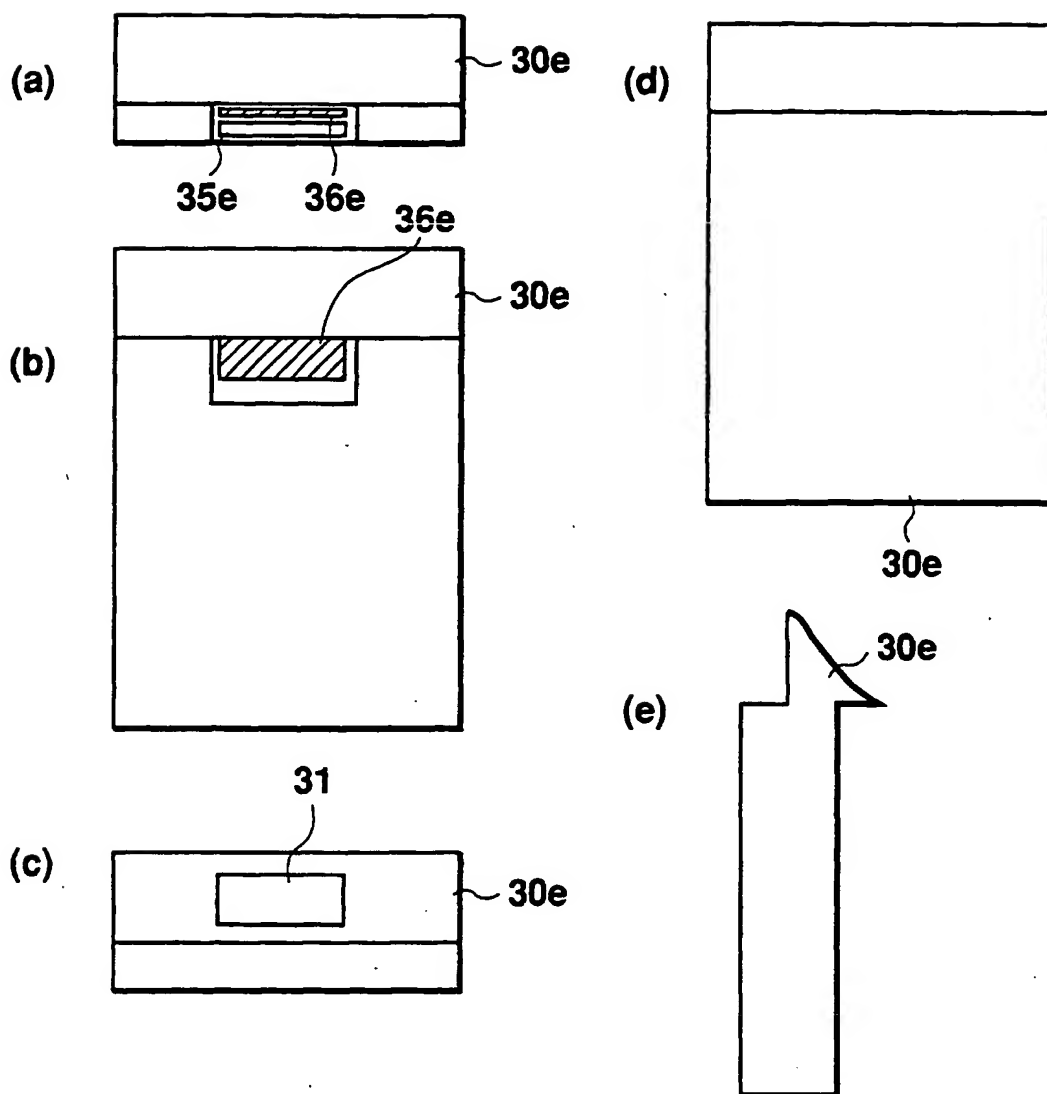


Fig. 21

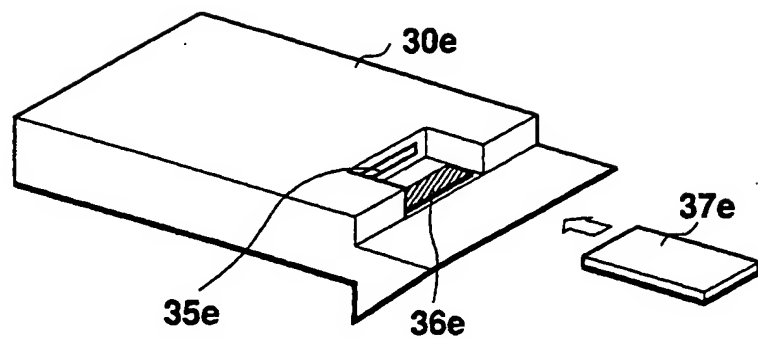


Fig. 22

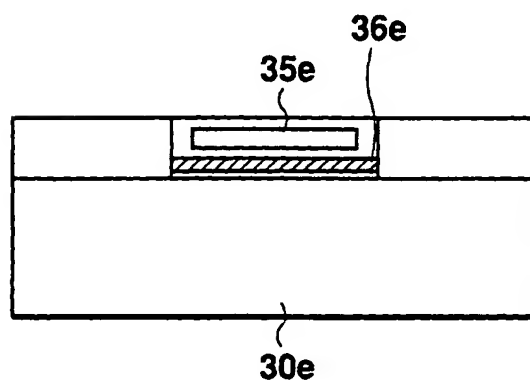


Fig. 23

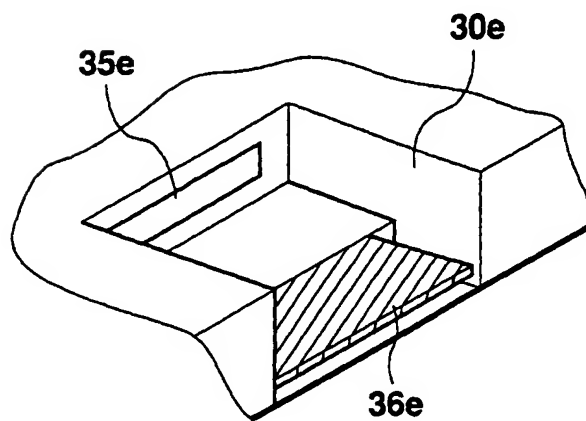


Fig. 24

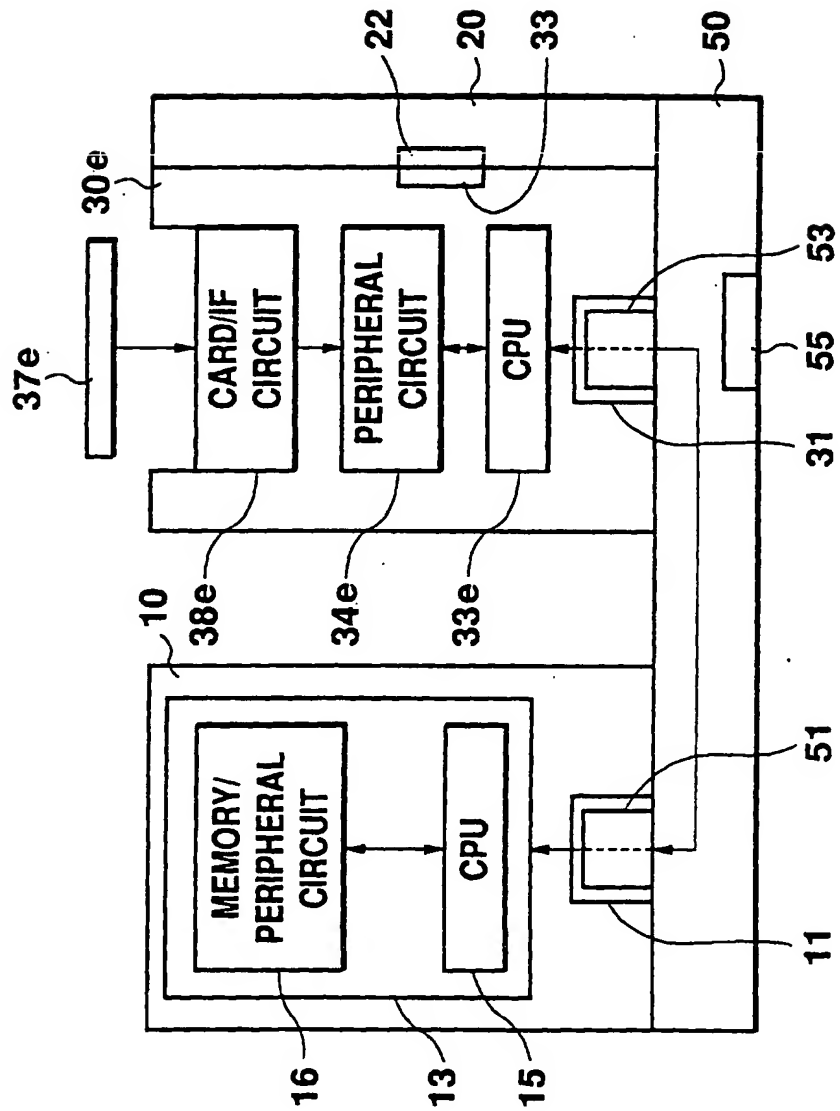


Fig. 25